Efficient room-temperature silicon LED created using dislocation loop arrays

Researchers at the University of Surrey (Guildford, UK) have made silicon-based LEDs using standard processing techniques to create an array of dislocation loops (from 30 keV boron implants on an n-type substrate) rather than using quantum dots, wells, wires or even porous silicon (*Nature* **410**, pp192-194, March 8).

The array of dislocation loops is typically 80-100 nm in diameter with 20 nm spacing, and is formed parallel to the p-n junction at a distance of 100 nm using a nitrogen anneal at 100°C for 20 minutes). The dislocations introduce a local strain field that prevents non-radiative recombination of electrons and holes.

At room temperature, quantum efficiency was around 0.02%, (based on light through the back window). There is also significant edge emission, increasing QE to about 0.1% (compared to about 1% for GaAs infrared LEDs). Commercial packing (e.g. minimising the internal reflection losses of the planar device and collecting the edge emission) could improve QE by up to a factor of 15, they believe. "Our first non-optimised devices are therefore already within a factor of three or so of the efficiencies achieved in conventional optimised LED devices."

The approach could also be applied to other indirect semiconductors and silicon alloys, spanning 1.3-15 μm near-infrared optical communication wavelengths up to UV. The current device peaks around 1.13-1.18 μm.

Single white LED yields 17 lumens

LumiLeds Lighting (San Jose, CA, USA) has demonstrated a single white LED which operates at 350 mA and 3.2 V_f with an output of 17 lumens.

This is four times more than the best known single-point white LED (see article on page 44) and the first in the light output range required for general lighting (which is not possible with traditional low-power 5 mm white LEDs without using multiple LEDs, says LumiLeds).

LED demand shifting from mobiles to high-brightness displays

Cree Inc (Durham, NC, USA) still expects sales for the March quarter of about US$52m, but June-quarter sales will be down 10-15% to US$45-48m. Cree cites an increasingly competitive and slowing market for LED chips.

As long as economic conditions improve, sequential growth could resume in the last quarter, assuming September-quarter growth remains flat on June. The target for fiscal 2002 (to mid-2002) is US$200-240m.

CEO Neal Hunter says, "We have much of the equipment and facilities in place to serve a growing market over the next 12-18 months as economic conditions improve. This should limit capital spending requirements."

Despite a slowdown in some segments of the market, **Uniroyal Technology Corp** (Sarasota, FL, USA) says demand remains strong for high-brightness LEDs for backlighting and ultra-high-brightness LEDs for signage, outside displays and traffic signals such as GaN blue and AlInGaP 626 nm red LEDs.

Strategies Unlimited (Mountain View, CA, USA) says the HB-LED market grew 55% from 1999 to US$1.2bn in 2000, and projects growth of 22% annually through 2005 to US$3.4bn.

Markets such as LCD backlighting for mobile phones may experience a slowdown, but demand for very-high-brightness products for outside video displays, signage and traffic signals remains strong.

Higher brightness levels have reduced the number of LEDs required, resulting in more cost-efficient conversion from incandescent to LED lighting.

China develops DVD laser

After two years of efforts (with funding from China's development plan Program 863), researchers headed by Chen Lianghui at the Chinese Academy of Sciences (Beijing, Xinhua, China) have developed a 650 nm laser for pick-ups in DVD players and CD-ROMs. Production has been initiated at a capacity of 100,000 lasers per month.

The lasers have passed testing by Japanese company Pulstec. Also, trial use by companies set up in China by Toshiba and Hitachi show that it is on a par with products such as Toshiba's TOLD 9441, it is claimed. A group of Japanese and Korean DVD pick-up producers have also requested samples.

"The demand for DVD players worldwide is expected to reach 120m, including 10m from China, and 80m DVD players will be used for personal computers", says Li Yuzhang (Academy research fellow and executive deputy director of the National Engineering Research Center for Optoelectronics Devices).

A joint venture is planned with domestic companies for an annual capacity of 15m lasers.

GELcore launches its first InGaN blue and green LEDs

General Electric and EMCORE joint venture GELcore (Valley View, OH, USA) has launched its high-efficiency blue, green, and blue-green high-brightness InGaN LEDs. This is the first of several InGaN families at dominant wavelengths of 470, 505 and 525 nm (rated ESD Class II).

GELcore now offers discrete HB-LEDs across the broad visible spectrum.